The life-threatening aspects of compound semiconductors are well understood. But when the toxic materials are treated with respect, under controlled conditions the final products - devices - are relatively harmless. Despite some occasionally bad (often uninformed) publicity III-V devices have largely overcome their potential drawbacks. In fact, they are becoming increasingly important for life-enhancing and even life-saving applications. This is particularly true for opto, but looks likely in due course to include microwave and mm-wave radiation components

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Life-saving III-Vs

Despite having origins in warfare systems, GaAs and related semiconductors are becoming increasingly important in the life sciences. Not only can opto devices offer the means to exploit previously unavailable wavelengths for diagnostics, but they also enhance surgical and therapeutic techniques.

Today, these new approaches complement established methods, but in the near future we may see something of a revolution in the field, largely thanks to III-V devices such as lasers, detectors and LEDs.

For example, the US company IDSI has scored several notable sales of its CTI Laser Breast Imaging systems. This machine addresses many of the concerns associated with current mammography techniques. In particular, in the CTI system the x-ray source is replaced by a laser, illustrating how semiconductor technologies can augment and improve traditional approaches. By combining more rapid diagnoses and non-invasive techniques, these systems provide a much less traumatic patient experience. In fact, there are some industry observers who suggest that such new techniques are paving the way for an era where for some of today's operations no surgery will be needed. This has many obvious advantages in all aspects of medicine. Most important will be the major role that III-V devices will play in bringing this about.

Compounds are already helping out in many medical areas, albeit on a less major scale. Improvements in lighting, such as surgeons' headsets and overhead illumination using white LEDs, are in the news. These low-power, high-brightness units* make sure that neither the doctor or patient suffer from overheating. Alternatively, there are UV LEDs for the sterilisation of surgical tools and even body parts, etc. Not only will these devices replace today's less robust, more expensive tube lamps but they will also forge new market opportunities.

There is also heightened interest in the short wavelength region now that all-solid-state violet laser diode (VLD) sources have become commercially available. One interesting application is confocal microscopy. In this field a VLD light source has the potential to replace argon ion lasers for a range of fluorescence based imaging systems.

Longer wavelength (IR) lasers are now popular for dermatological and other treatments. For example, companies are looking to exploit opportunities in dentistry; and in dermatology for removal of blemishes such as birthmarks and tattoos. LEDs are important here too. The low-cost (under £300) DermLite DL100 is a hand-held dermatascope that can speed up early detection of melanoma. It provides 'enhanced visualisation of pigmented skin lesions' thanks to 8 LEDs for 'bright-white, natural illumination'. Cosmetic applications for laser treatments include hair removal and non-invasive wrinkle treatment.

Due to its compact size and low purchase price, the laser offers a useful addition to the spectrum of therapeutic methods available, particularly for small practices and out patients.

However, owing to limitations in wavelengths and beam width, lasers are not ideal for all clinical applications. For example, NASA has a programme looking at combining wavelengths of light for wound healing. They say that these cannot be efficiently produced, and the size of wounds which may be treated by lasers is limited. LEDs offer an effective alternative. Experiments suggest potential for using LED light therapy at 680, 730 and 880 nm simultaneously, alone and in combination with hyperbaric oxygen therapy to accelerate the healing process in space, where prolonged exposure to microgravity may otherwise retard healing.

US company, Light Diagnostics is exploiting the special characteristics of superluminescent diodes, a hybrid of the LED and laser diode. While conventional lasers, such as the titanium-sapphire laser, cost several hundred thousand dollars, III-V light sources can cost one-tenth of that, the company says. Today's imaging products using 70nm bandwidth sources will soon be joined by higher-resolution systems with a spectral bandwidth of up to 150nm. Relatively lower-cost, coupled with high performance and portability, thanks to optoelectronics, should see a whole new generation of non-invasive diagnostic products in the not too distant future.

Of course, all of this will be no overnight success. Companies in the market have to gain official governmental approval for their products. The medical market segment should nonetheless prove to be an attractive application area for compound devices. We can look ahead to the time when it becomes a useful and perhaps steadier adjunct to the more volatile price-sensitive telecom and data storage market segments.

* You can watch a video of white LED goggles in action at Web:http://www.yanchers.jp/eng/en_index.html